NEW ZEALAND

DEPARTMENT OF CIVIL AVIATION

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NEW ZEALAND'S FUTURE SYSTEM OF LICENSING AIRCRAFT MAINTENANCE ENGINEERS

The first aircraft maintenance engineer licence to be issued in New Zealand was granted to N.C. Walsh on 4 October 1921. It covered Categories A, B, C and D, as did a number of other licences issued shortly afterwards.

Through the twenties and thirties, New Zealand's licensing system kept in step with that of the United Kingdom, but the two systems began to diverge in the years after the Second World War. Whilst the Air Registration Board in the U.K. tended to put less emphasis on individual responsibility for the certification of major work and substituted the concept of collective responsibility embodied in the approved inspection organisation, New Zealand strengthened the authority of the licensed aircraft engineer. The New Zealand Civil Aviation Regulations 1953 require that all aircraft inspection and all work done, including overhaul work done under approved conditions, shall be inspected by, or under the supervision of, an aircraft maintenance engineer licensed for the purpose.

Although contradictions and anomalies have crept into the New Zealand system, in general the Department of Civil Aviation, supported by the aircraft industry, has upheld the view that air safety is best guaranteed by ensuring that only persons qualified according to nationally-determined standards are granted certification privileges. Approving a company or inspection organisation to nominate its own signatories for certificates of compliance and similar documents simply transfers the selecting and examining process from an impartial Government body over to a firm which may be poorly equipped for this particular purpose. It is really rather surprising that elsewhere the approval of companies should sometimes have been seen as a substitute for a state licensing system, and New Zealand has only occasionally flirted with this approach. The consequences of such flirtation were restrictions on the scope of some licences, e.g. turbine engines could not be included on "D" licences, although the full implications of finding an alternative policy were never explored.

However, although the core of New Zealand's policy - reliance on licensed aircraft engineers - has always been sound, the actual system has been rendered obsolete by aeronautical developments.

THE LICENSED ENGINEER IN THE JET AGE

The existing system of licensing has evolved through the piston engine era into a system where emphasis is placed on detailed knowledge of the particular aeroplane, engine or equipment the licence holder is privileged to certify. In most countries of the British Commonwealth licences have been granted after examinations which require a fairly elementary knowledge of engineering fundamentals but a detailed awareness of the type of hardware concerned. It is easy to understand the perplexity of examiners and applicants confronted with third generation jets and the S.S.T.

Shying away from the problem of trying to examine individuals on their knowledge of such hardware, there has been talk of shelving individual licences on 'advanced technology' concepts and granting certification privileges only to approved organizations, reserving the traditional licensing system for general aviation. New Zealand has rejected this approach and is meeting the challenge of the new aeroplanes by shifting the weight of the licence examination towards the fundamental and away from the memorization of type knowledge. This has sometimes been described as the 'North American' approach.

Experience in aviation, as in other branches of engineering, confirms that maintenance and trouble-shooting on a wide variety of equipment, can be broken down into manageable blocks of knowledge readily understood by persons of technician calibre. The problem today is the variety of blocks of knowledge required for understanding of the interrelated mechanical-hydraulic-aerodynamic-electronic complexities of the modern turbine transport. All these blocks of knowledge however derive from study of two fundamental subjects - college physics and workshop technology. The principle of producing the sound maintenance technician is based on a thorough grounding in these basic subjects; the man so trained can then use his fundamental knowledge to further rapid understanding of particular applications.

Confusion has sometimes arisen between the responsibilities and functions of licensed aircraft engineers and aircraft tradesman. Whilst the Regulations and Requirements governing the knowledge, experience and privileges of licensed engineers do not preclude licence holders from functioning as tradesmen, licences are issued to delegate authority for inspection, supervision and certification to competent persons. These persons must prove to the State their competence to assess the airworthiness of the aeroplanes, engines or equipment for which they are licenced; they rarely have to prove their competence to perform trade tasks. Whilst in the past trade ability and inspection ability were usually united in the same individual, the trend today is towards separation and the inspector/supervisor is most often identified as a technician. In the majority of I.C.A.O. States, the technician is trained through different channels from the tradesman.

The proposed new New Zealand licensing system is based on a permanent qualification, generally called a "Basic licence". Several other British Commonwealth states are now investigating and planning the introduction of basic licences. Basic licences provide a much better index of technical ability than licences which are linked to the ephemeral existence of particular pieces of hardware. In some circumstances supervisory privileges may be granted to basic licence holders irrespective of type ratings, although certification privileges will be conferred only in respect of equipment for which the holder is rated.

It is intended that the new licensed technician should be trained in depth in inspection and trouble-shooting techniques, so that, when equipped with the appropriate manuals and after type training on the more complex equipment, he can verify the airworthiness of any aircraft. The multiplicity of smaller aeroplanes, engines and categories of equipment will be in groups for rating purposes, but large transport aircraft will require individual ratings. However, it would obviously be ludicrous to expect engineers rated on, say, the Concorde to store complete details of all its structure, controls and systems in their minds. Rather they will have learned the principles of structures, controls and systems in the basic phase, they will have obtained experience and completed a familiarization course for grant of their rating, and they will use manual readouts and programmed test equipment when they inspect the aeroplane.

It is also obvious that not an individual but a team is required to certify the jumbo jets and other large transports, although the signatures on the maintenance release can be limited to very few, with two as the probable minimum. The principle that should govern certification on the maintenance release is that the signatories should, between them, be capable of verifying the airworthiness of the complete aeroplane, as far as this is possible, by line inspection and functioning checks. If the signatories lack this competence over the complete aeroplane with all its avionic systems, there is no point in requiring technical persons to sign the document, the signature of any clerk would do as well.

BASIC LICENCES IN NEW ZEALAND

Recent years have brought about a considerable convergence of technologies previously applied in fairly watertight compartments; hence electronics pervade systems which were formerly purely mechanical, hydraulic or pneumatic; and electrical, instrument and electronic techniques are integrated in navigational and automatic flight installations. In conjunction with this technical fact is the economic fact that it is not expedient to train or employ too many separate categories of technicians or licensed engineers.

The Department of Civil Aviation, on the advice of an advisory committee drawn from the aircraft industry, is reducing the technical categories of licences to two. These are Mechanical and Avionic. A basic mechanical licence requires knowledge of airframes and engines; a basic avionic licence requires knowledge of electrics, instruments and radio/radar.

However each of these licences is divided into two levels, known familiarly as "minor" and "major" and corresponding to the I.C.A.O. Type II and Type I categories respectively.

Holders of minor licences with ratings for particular aeroplanes, engines or equipment will be authorised to certify at the line maintenance level, i.e. certifications similar to those at present made by holders of 'A', 'C', 'X' (Radio Stations) or 'X' (Radar Stations). Holders of major licences will have these same privileges and will additionally be able to certify after overhaul, major repair or major alteration. The major licence mechanical will therefore confer, if rated for both airframes and engines, the same privileges as 'A', 'B', 'C' and 'D'. To convert a minor to a major licence, two further written basic examinations have to be completed: for both the mechanical and avionic licences these further examinations require deeper knowledge of overhaul, repair and testing techniques.

For both mechanical and avionic licences there will be five "common core" subjects to be completed:

(i) Physics

(ii) Technical Drawing

(iii) Workshop theory and machine units

(iv) Aircraft electrics and electronics

(v) Aircraft instruments.

The student taking the mechanical option will have five further written papers for the qualification which, after passing an oral examination on Regulations, will bring him a minor licence. These papers cover:

(i) Aerodynamics

(ii) Aircraft Engines

(iii) Aircraft Structures and Landing Gear

(iv) Aircraft Systems

(v) Aircraft Materials.

To convert this minor licence to a major licence, there are two additional papers, the first on "engineering inspection and materials testing" and the second on "the principles and practice of overhaul".

The student following the avionic path likewise has five subjects after the common core. These are:

(i) Aircraft General Knowledge

(ii) Avionic Physics

(iii) Electronics I

(iv) Avionic Systems

(v) Avionic Test and Measuring Equipment.

The two further subjects to extend to the major avionic licence are listed as:

(vi) Electronics II

(vii) The Principles and Practice of Avionic Overhaul.

For the issue of any basic licence, the applicant must have passed the required written examinations and obtained the associated certificate. This is likely to be a New Zealand Certificate of Engineering in Aircraft Maintenance issued by the Technician's Certification Authority. This Authority is expected to implement examinations based on the syllabi prescribed by the Director of Civil Aviation. On presentation of the Certificate to the Department of Civil Aviation, the applicant will be orally examined on his knowledge of air regulations. This is the final step; if successful he is granted a permanent basic licence.

This basic licence does not carry authority to certify, but certification privileges are readily added to it by the rating system outlined below.

THE RATING SYSTEM

Ratings are added to basic licences in respect of groups or individual aeroplanes, engines or equipment. The general principle is that ratings on the minor basic licences permit line maintenance certification of airframes, powerplants, instruments, electrics and radio installations in respect of the aeroplane type (or group of types) listed in the licence. Where the types are relatively simple, they will be grouped and the whole group will be awarded in a single package when the required experience has been obtained. However ratings for large transport aircraft or the higher powered turbine engines, or avionic installations above a certain level of complexity, have to be acquired individually and completion of a type course is a mandatory criterion.

Although the details are not yet finalised, it seems probable that aeroplanes will be divided into three groups. The first group will embrace the wide range of light aircraft up to perhaps 8000 lb AUW, the middle group will be multi-engined aircraft with relatively simple systems, the third group will be the sophisticated transport aircraft. For the middle group, courses will not be compulsory but ratings will be obtained in less time if an approved course has been completed. Similar standards will apply for engine ratings on the mechanical basic licences. The holder of a minor basic licence who subsequently extends it to major level will retain the same ratings, as far as these are applicable, but will now be able to certify after overhaul or major repair. However the privileges of a major licence may only be exercised if the holder is working within an appropriately approved organization. It is also possible for the Chief Inspector of an approved organization to grant company ratings for such classifications as "all hydraulic equipment" or "Rotol variable pitch propellers". In practice, those who wish to specialise in airline overhaul shops may aim only at company ratings, which can be granted to any holder of a major basic licence.

On the avionic side, ratings on the minor licence will be in respect of similar groups or individual aeroplanes as on the mechanical licence, except that the privileges are now confined to certification of electrical, instruments and radio/radar installations in situ. However, ratings on the major avionic licence obviously have to relate to equipment as distinct from systems, and here there are three broad groups of ratings. They are:

(i) Electrical Equipment.

(ii) Instruments and Autopilots

(iii) Radio and Radar Equipment.

Whilst the full rating issued by the Department is comprehensive for the group of equipment concerned, company ratings may be issued which are applicable only to particular types of equipment.

It is intended to include sufficient avionic content in the mechanical licence to enable the man with airframe ratings on the simpler aeroplanes to certify the complete aeroplane, including its electrics, instruments and electronic installations. The more complex aeroplanes on the other hand, will be checked out, and the maintenance certified, by appropriately rated mechanical and avionic engineers working in conjunction.

HOLDERS OF EXISTING LICENCES

After 31 March 1972 no more licences of the existing types will be issued, but those already holding them can continue to certify. There is no time limit for conversion to the new system; indeed holders may retain existing licences for the rest of their lives if they so wish.

Holders of 'A' and 'C' licences may apply for mechanical minor licences immediately. If they also have a 'B' or a 'D' licence, they may apply for a major licence. If they have 'A' and 'B' but no engine licence, they can sit a 'cross-over' examination on engine knowledge to qualify for a major licence. In general a principle of equivalency applies but cross-over examinations will be rather simpler than the initial examinations for newcomers to the profession. Combinations of multi-choice questions will be put together to meet each individual case.

Holders of existing 'X' licences present rather more of a problem than do their mechanical counterparts. Most New Zealand 'X' licences are for overhaul rather than line maintenance, the exceptions being the "radio stations", "radar stations" and "compass" licences. A licensed engineer holding the three last named could convert to a minor avionic licence by passing a multi-choice examination on instrument and electrical systems knowledge, his existing ratings being transferred to the new licence. On the other hand, the holder of an 'X' electrics licence only might be required to pass two or three extra examinations to obtain an avionic major licence.

It may be expected that a few inconsistencies and difficulties will arise during the transition period, but there is no complusion to convert and some holders of existing licences may do better to retain them indefinitely.

TRAINING FOR BASIC LICENCES

Irrespective of New Zealand's changing licensing system, the point has been reached when more attention must be paid to basic training for aircraft maintenance. Aviation is expanding across the world at a spectacular rate and this is creating an international shortage of maintenance personnel. Although the present expansion rate in New Zealand is below the world average, the next decade will see the retirement of many senior engineers coincident with the import of more types of aeroplanes. The inevitable consequence will be a short fall in trained maintenance engineers during the 1970's, unless measures are taken in the near future to step up basic training.

If the old licensing system were perpetuated, it would be necessary to train separately in such overlapping technologies as electrics, instruments and radio, with consequent higher expenditure and reduced efficiency. Whichever of these options a student might choose today, a large element of electronic training would be necessary so that it becomes unrealistic to defend any training which does not combine three into "avionics".

It is anticipated that, coincident with the introduction of the new licensing system, training will be inaugurated according to the licence examination syllabi by the apprentice training schools of Air New Zealand and National Airways Corporation. The Chief Instructors of these two airlines have helped to make the syllabi. The Technical Correspondence Institute will also be providing courses for the new licences. Even so the full needs of New Zealand will not be met; in particular the general sector of the industry is going to need much better training back-up. The answer to this is provision of college-type training facilities, and ways and means of doing this are at present being discussed.

LICENCES AND APPROVED FIRMS

In New Zealand, firms undertaking overhaul or repair of aircraft must be approved in accordance with the regulations. Approval signifies that the firm is competent and properly equipped for the tasks for which it is approved. Within approved organisations, the supervision and inspection of work must be by a licensed aircraft maintenance engineer or "some other person approved for the purpose".

With the new licensing system, no drastic changes in approval procedure are foreseen: in the future, as now, the majority of supervision and inspection will remain the responsibility of licensed engineers. One new innovation is that Chief Inspectors can issue company ratings to holders of basic licences, thus enabling particular items or categories of equipment to be certified by persons who may not meet the full requirements for a nationally-awarded rating. In some instances, to meet particular specialist requirements, unlicensed persons may be authorised to make certifications, e.g. the man in charge of a plating shop might be granted a Certificate of Competency instead of being required to hold a full licence.

SUMMARY

The core of the New Zealand system of airworthiness is dependence on the licensed technician as supervisor and inspector of all maintenance work. The system and the training are being changed to suit new concepts of maintenance technology, and this leads to higher standards than are required of tradesmen. The licensed engineer is now seen as a man who can determine the airworthiness of parts by monitoring their performance, who can trouble-shoot complex "multi-technology" systems, who can use many kinds of test equipment, and can co-ordinate, direct and inspect the work of a variety of skilled tradesmen. He possesses a combination of technical and legal knowledge, some managerial ability and a deep sense of responsibility for safety in flight.

It is anticipated that the new style maintenance technician will combine the traditional integrity of this profession with a mastery of the cybernetics of modern maintenance.